

## Photoseries analysis (for ES supply)

### Introduction

Revealed preference for Cultural Ecosystem Services (CES) and spatially-explicit data on location for nearby CES provision can be obtained from popular social networks. Photoseries databases can be acquired from photo-sharing websites such as Flickr, Panoramio and Instagram. The analysis of community-contributed photos can be used as a complementary technique to interviews, questionnaires or focus groups to assess preferences for CES, assuming that visitors are attracted by the location where they take photographs. The method allows those CES to be identified which are perceived as the most important by the people who take the photographs and to map their distribution.

### Keywords

Cultural ecosystem services; Non-monetary values; Photo-analysis; Social media platforms; Social perceptions.

### Why would I chose this approach?

This method represents a pragmatic way of gathering space-and time-referenced data on observed people preference related to cultural ecosystem services which are difficult to obtain in a cost-effective way through traditional data gathering techniques (e.g. social surveys). The method allows an understanding of the spatial distribution of cultural ecosystem services in areas with low baseline information (Martínez-Pastur et al. in press).

The objectives addressed by photoseries analysis are the identification of socio-biophysical features of landscapes associated with cultural ecosystem services provision and the spatial trade-offs and synergies among cultural ecosystem services (Martínez-Pastur et al. in press).

The analysis of geo-tagged photographs from social networks can be used to assess the actual provision of different cultural ecosystem service categories, including recreation, aesthetic, intellectual and existence.

The method can be used for awareness raising, it allows the identification of focus areas where landscape plans and ecosystem management strategies should take into account the actual provision of non-material benefit of ecosystem services.

The method can be applied at different spatial scales, ranging from municipality to nation, according to context. It has been already applied at the continental, regional and city scale (e.g. Martínez-Pastur et al. in press, Richards and Friess, 2015, Tenerelli and Luque, 2015, Willemen et al., 2015). The method is based on volunteered geographic information whose resolution depends on several factors (mainly the accuracy of the used GPS-enabled devices, or the map scale used to specify the photo location). Count data can be produced at different cell sizes, from 1da to 10 km<sup>2</sup>, depending on the chosen platform and geographic region (Zielstra and Hochmair, 2013), density of photographs, and scale of analysis.

## What are the main advantages of the approach?

- Photoseries analysis represents a pragmatic way of gathering space-and time-referenced data on observed people's preferences related to CES which are difficult to obtain in a cost-effective way through traditional data gathering techniques (e.g. social surveys);
- It allows further understanding on the spatial distribution of CES in areas with low baseline information (Martínez-Pastur et al., in press);
- It permits the identification of socio-biophysical features of landscapes that are associated with the provision of CES and with the spatial trade-offs and synergies among CES (Martínez-Pastur et al., in press).
- Ease of use
- Speed of use
- Draws on existing data
- Allows for spatially explicit analysis
- Allows the identification of focus areas where people benefit from cultural ecosystem service provision

## What are the constraints/limitations of the approach?

- Socio- and psycho-cultural aspects are crucial in order to define different values from the point of view of individuals and society. This method doesn't allow information related to the user characteristics to be directly obtained which could reveal significant correlations with the photo content;
- People's attitude to taking photographs change with the different recreation activities (Wood et al., 2013). Certain activities are therefore less well represented, for example rock climbers may take less photos than people having a picnic;
- The photo-sharing community may not be representative of specific social groups: the represented population will then be dependent on the level of access to information technology, education and age, and the user's ability/willingness to correctly geotag the photos;
- To appraise the importance of CES services through the number of uploaded photographs entails an inherent bias related to the interpretation of the photos by researchers and to the capacity to photograph certain CES. For example, it is quite challenging for researchers to identify sacred areas or traditions in photographs (Martínez-Pastur et al., in press).

## What types of value can the approach help me understand?

Photoseries is predominantly used as a means to understand socio-cultural revealed preferences for cultural ecosystem services such as recreation, species appreciation, aesthetic beauty and cultural/natural heritage.

## How does the approach address uncertainty?

The approach does not explicitly address uncertainty.

## How do I apply the approach?

The photoseries analysis consists of a classified set of pictures downloaded from a selected social network. The number of photographs uploaded on the most popular social media for photo sharing (Flickr, Panoramio or others) should be compared in order to identify the platform with the highest number of photos. There is not a given definition for the necessary numbers of photos; for case studies with a large area extension a sampling strategy may be used. Guidance on sampling can be obtained from Richards & Friess (2015) who simulated different levels of sampling effort using a boot-strap resampling method. Rights in relation to the use of the photos will depend on the country and the use. Only photos entered as public should be used and the photo and the users' personal data must not be published. GIS information on environmental characteristics and infrastructures which may affect the CES should also be captured.

An Application Programming Interface (API) can be used to retrieve all the geotagged public pictures uploaded on the image hosting website for a given area (e.g. Flickr API). Some APIs allow the query to be limited to photographs with the most precise recorded accuracy level (street level); other sampling strategies may be used to reduce the number of pictures.

A hierarchical classification scheme is used to classify the different CES, and the different sub-categories are selected according to the specific study area characteristics. The photo classification is conducted through a systematic visual analytic process. This process can also be performed in a GIS environment which allows the different information layers to be overlaid, such as satellite images and thematic maps. All photos which are not related to CES and those which are tagged with the wrong location should be deleted through the systematic visual analysis, based on expert knowledge and multi-media supporting data (background satellite images, virtual globes and land use/land cover data). In general, it is possible to classify around 50 photos in 1 hour. Different professionals should discuss the photo content in order to agree on the interpretation.

Once the classified photoseries has been created the data can be analysed on a GIS platform in order to identify spatial trends. Different multivariate statistical analysis and spatial regression models can be applied to identify environmental properties which represent the major predictors of nearby recreation and other associated CES.

## Requirements

<i>Data</i>	<input checked="" type="checkbox"/> Data is available <input checked="" type="checkbox"/> Need to collect some new data <input type="checkbox"/> Need to collect lots of new data	Public photos can be downloaded from social networks.
<i>Type of data</i>	<input type="checkbox"/> Qualitative <input checked="" type="checkbox"/> Quantitative	Number of uploaded photographs. Socio-biophysical features associated with CES supply.
<i>Expertise and production of knowledge</i>	<input checked="" type="checkbox"/> Work with researchers within your own field <input checked="" type="checkbox"/> Work with researchers from other fields <input checked="" type="checkbox"/> Work with non-academic stakeholders	Different professionals should discuss the photo content in order to agree on the interpretation. Other methods such as interviews, questionnaires or focus groups should be integrated in order to take into account socio and psycho-cultural aspects which are related to values.
<i>Software</i>	<input checked="" type="checkbox"/> Freely available	

	<input type="checkbox"/> Software licence required <input type="checkbox"/> Advanced software knowledge required	
<i>Time resources</i>	<input checked="" type="checkbox"/> Short-term (< 1 year) <input type="checkbox"/> Medium-term (1-2 years) <input type="checkbox"/> Long-term (more than 2 years)	
<i>Economic resources</i>	<input checked="" type="checkbox"/> < 6 person-months <input type="checkbox"/> 6-12 person-months <input type="checkbox"/> > 12 person-months	
<i>Other requirements</i>		

## Where do I go for more information?

Flickr Application Programming Interface (API):

<https://www.flickr.com/services/api/explore/flickr.photos.search>

Casalegno, S., R. Inger, C. DeSilvey, and K. J. Gaston. 2013. Spatial Covariance between Aesthetic Value & Other Ecosystem Services. *PLoS ONE* 8:e68437.

Keeler, B. L., S. A. Wood, S. Polasky, C. Kling, C.T. Filstrup, and J. A. Downing, 2015. Recreational demand for clean water: evidence from geotagged photographs by visitors to lakes. *Frontiers in Ecology and the Environment*, 13(2), 76–81.

Martínez Pastur, G., P. L. Peri, M. V. Lencinas, M. García-Llorente, and B. Martín-López. In press. Spatial patterns of cultural ecosystem services provision in Southern Patagonia. *Landscape Ecology*.

Nahuelhual, L., A. Carmona, P. Lozada, A. Jaramillo, and M. Aguayo. 2013. Mapping recreation and ecotourism as a cultural ecosystem service: An application at the local level in Southern Chile. *Applied Geography* 40:71–82.

Richards, D. R., and D. A. Friess. 2015. A rapid indicator of cultural ecosystem service usage at a fine spatial scale: Content analysis of social media photographs. *Ecological Indicators* 53:187–195.

Willemen, L., A. J. Cottam, E. G. Drakou, and N. D. Burgess. 2015. Using Social Media to Measure the Contribution of Red List Species to the Nature-Based Tourism Potential of African Protected Areas. *PloS One*, 10(6), e0129785.

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